Answer the following questions: (Assuming any missing data)

1) An infinite line charge of charge density $\rho_1 = 2nC/m$ lies along the x axis in free space, while two point charges of 8nC are located at $(0, 0, 1)$ and $(0, 0, -1)$. Find E at $(2, 3, -4)$. To what value should ρ_1 be changed to cause E to be zero at $(0, 0, 3)$?

2) Within the cylindrical region $\rho \leq 5$ m, the electric flux density is given as $4\rho^2 a_\rho \ C/m^2$.

   (a) What is the volume charge density at $\rho = 2m$?

   (b) How much electric flux leaves the cylinder $\rho = 2, -5 \leq z \leq 5$?

   (c) How much charge is contained within this cylinder?

3) In cylindrical coordinates two $\varphi = $ constant planes are insulated along the z axis, as shown in Fig.1. Find the expression for the capacitance and E between the planes, assuming a potential of 100 V for $\varphi = \alpha$ and a zero reference at $\varphi = 0$.

   Fig.1
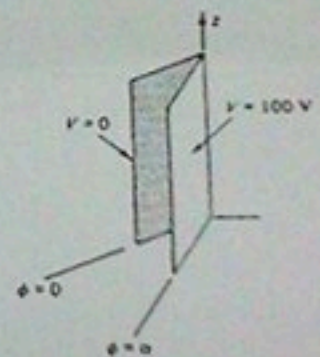
4) (a) Find H in Cartesian components at $p(2, 3, 4)$ if there is a current filament on the z axis carrying 8 mA in the a_z direction.

   (b) Repeat if the filament is located at $x = -1, y = 2$.

   (c) Find H if both filaments are present.

5) A 100 MHz uniform plane wave is propagating in a medium of $\varepsilon_r = 2.56$. If the amplitude of the electric field intensity is 8 mV/m. Find the following parameters:

   (a) The phase velocity.

   (b) The wavelength.

   (c) The phase shift constant.

   (d) The intrinsic Impedance.

   (e) The amplitude of the magnetic field intensity.